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# PROCEEDINGS

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## DISCUSSION OF SURVEYING AND MAPPING REQUIREMENTS FOR MODERN CITY PLANNING

*(Published in February, 1951)*

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SURVEYING AND MAPPING DIVISION



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## DISCUSSION

HAROLD M. LEWIS,[15] M. ASCE.—The kinds of maps in which city planners are vitally interested are discussed in this paper, which makes a strong plea for greater standardization. The writer believes the problem would be clearer if one grouped such maps under the following two headings: (1) base maps, for which the city engineer and surveyor is primarily responsible; and (2) maps presenting basic planning studies, for which the city planner is responsible and which can generally be presented with base maps as a foundation.

For many years city planners have been handicapped by the lack of adequate base maps. Often they have had to make their own based upon whatever existing maps were available. Many communities are still without an accurate street map, and in many places the only topography available is that shown on United States Geological Survey (USGS) maps made many years ago by plane-table methods. This type of mapping can and should be standardized. The second group of maps—that is, those showing basic planning studies—will vary widely, both in scale and material shown, with the size and character of the community.

There is a border line between map needs for city planning and map needs for the city engineer and various city departments. The city planner is primarily interested in the location and general character of improvements, existing and proposed. The city engineer and department staffs need enough information for the design and construction of those improvements. The former, therefore, wants a true scale, whereas the latter need true dimensions.

On this basis (in a typical case) the city planner might well settle for a base map at a scale of 1 in. equals 400 ft with 5-ft contours, while the city engineer would want a scale of 1 in. equals 200 ft or 100 ft, and 2-ft contours. The city planner could make effective use of an air mosaic and a few oblique air views, but the city engineer would want these plus a photogrammetric map. Both should work together in developing a suitable mapping program and in developing the city plan.

The New York Regional Survey and Plan, referred by Mr. Blessing, presents one extreme, and it was necessary to use the only region-wide maps available, that is, the USGS maps, which were enlarged from 1 to 62,500 to 1 to 24,000 (1 in. = 2,000 ft), at which scale the Plan was drawn. The printed Plan was reduced back to the scale of 1 to 62,500 (approximately 1 in. = 1 mile). Although more accurate and complete base maps would have been of tremendous help in this work, no such map as has recently been undertaken jointly by the City of Cincinnati and Hamilton County in Ohio, would have been justified. In the latter case 414 sq miles to be mapped by aerial survey methods were estimated to cost $1,120,000.[16] At this same unit cost per square mile, it would cost today nearly $15,000,000 to map the 5,500 sq miles in the

NOTE.—This paper by Charles A. Blessing was published in February, 1951, as *Proceedings-Separate No. 60*. The numbering of footnotes in this Separate is a continuation of the consecutive numbering used in the original paper.

[15] Cons. Engr. and City Planner, New York, N. Y.

[16] "Mapping Cincinnati," by H. H. Kranz, *Civil Engineering*, Vol. 20, February, 1950, p. 37.

New York region, whereas the total cost of the New York Regional Survey and Plan, including its ten volumes of reports, was about $1,300,000. Thus the statement quoted by Mr. Blessing, from one of the Regional Plan reports, that an accurate map would have cost more than the Survey and Plan proves to be a very conservative one.

Three general types of base maps are needed as follows:

1. Detailed base map for comprehensive studies and conferences;
2. Simplified base map at smaller scale for publication; and
3. Outline map for statistical presentation and studies of single elements of the plan.

The detailed base map should show both the visible features, such as drainage, culture, topography, and wooded areas, and invisible features, such as mapped streets versus those in existence, property lines, and the use of land and structures. The use of land and structures is particularly essential in zoning.

Mr. Blessing states (under the heading "Purpose of Paper") "* * * modern city planning is developing as a science." There is already such a science, with its techniques and principles well established, but these facts should not be permitted to put planning in a strait jacket. The city plan should be custom-made and not factory-made. Planning is actually more than a science. James Ford has described it as "* * * a science and an art * * *"[17] Thomas Adams defined it as "* * * a science, an art, and a movement of policy * * *"[18]

Planners have been accused of stating their principles in jargon, but are now attempting to simplify them in everyday language. If planners can get adequate base maps and simplified reports utilizing standardized basic maps at scales suited to the municipality, city planning will become better understood and will be more readily accepted.

LEON T. ELIEL[19].—The Committee on City Surveys of the Surveying and Mapping Division of the ASCE is in the process of revising Manual of Engineering Practice No. 10 ("Technical Procedure for City Surveys"). A considerable section pertaining to aerial photography and photogrammetry will be added.

In the paper a wide range of scales is mentioned ranging from 1 in. = 40 ft to 1 in. = 3,000 ft, a spread of 75-fold. Such a galaxy of scales and the attempt to assign a suitable scale for each different class of activity suggest that some basic consideration be given to the elements that go into the choice of a suitable scale for a particular map. Possibly the scale of the map is selected in order to permit measurements to be determined with a certain degree of accuracy. It is ordinarily accepted that a map can be scaled to about 0.02 in. Thus, if the map in question needs to be measured to an accuracy of 1 ft, at once there is an indication of the scale that is required (0.02 in. = 1 ft) or, to state it in the more conventional way, 1 in. = 50 ft.

[17] "Slums and Housing," by James Ford, Harvard Univ. Press, Cambridge, Mass., Vol. I, 1936, p. 490.

[18] "Outline of Town and City Planning," by Thomas Adams, Russell Sage Foundation, New York, N. Y., 1935, p. 21.

[19] Vice Pres., Fairchild Aerial Surveys, Inc., Los Angeles, Calif.

On the other hand, if the maximum scaling accuracy required of the map is 10 ft, then a suitable scale can be arrived at by starting with the expression 0.02 in. = 10 ft. Multiplying each side of the equation by 50 results in a scale of 1 in. = 500 ft.

Oftentimes accuracy is not the criteria for establishing a scale at all, but rather the scale is determined in order to provide ample layout space. If, for example, a map or plan is to be drawn on which each tread of a stairway needs to be shown $\frac{1}{8}$ in. wide, then the scale must be $\frac{1}{8}$ in. = 1 ft (the width of the tread), or 1 in. = 8 ft. Possibly the smallest feature that must be taken into consideration on a map is a 10-ft alleyway that must show as a double line. In such a case, perhaps the double line should be $\frac{1}{10}$ in. across, resulting in a scale of $\frac{1}{10}$ in. = 10 ft, or 1 in. = 100 ft.

Again, it may be that the governing criteria in the scale of a map is the need for room to contain a great deal of descriptive matter. In this case the space available for these printed blocks will be the determining factor in choosing the map scale. Possibly the smallest feature that it is desirable to show on a map will be one city block, which is 400 ft on a side. It may be considered that, if this city block is shown $\frac{1}{4}$ in. square, it will give an adequate representation for the map user. In this case the starting expression is $\frac{1}{4}$ in. = 400 ft, which gives a map scale of 1 in. = 1,600 ft.

Another factor that frequently will govern the choice of scale will be the desire to supply maps that conform to the size of existing filing facilities. Thus, possibly, a map of a city that is 5 miles across is desired all on one sheet, unfolded, that can fit into a 40-in. file. The required scale would, of course, be 8 in. = 1 mile.

In specifying a scale, consideration should always be given to the necessity for a particular scale. Ordinarily a certain scale connotes a certain measuring accuracy, but if this accuracy is not needed it costs a lot of money, and the scale can be achieved just as well by making the map initially at a smaller scale and enlarging by either photographic or graphic processes. A large-scale map costs money because it means that extra drafting is involved, unless the large scale is achieved by enlarging a smaller map. A large-scale map also means that from the beginning the process by which the map is derived will usually be carried on to a precision beyond that actually needed. So, in considering map scale, it is always well to analyze whether a certain scale is needed for accuracy or for space.

Photogrammetric methods are playing such an important role in the preparation of contour maps that it should be kept clearly in mind that (unlike the plane-table survey in which scale is usually the criterion of cost) the cost in photogrammetric mapping is usually more closely associated with contour interval. According to the different systems of photogrammetric mapping, the flying altitude may range anywhere from 250 to 1,250 times the contour interval. For this reason, the cost of a 2-ft contour is apt to be about 3 times the cost of a 4-ft contour. The photogrammetrist will fly twice as high for the 4-ft contour, and, therefore, he will have only one fourth the number of pictures and one fourth the amount of ground control. It is well, therefore, to carefully evaluate whether a 4-ft contour would suffice when the first reaction

is that a 2-ft contour is desirable. If the 4-ft contour will serve the purpose 90% as well, it obviously is good economics to buy it, because it will cost perhaps one third as much. With the remaining two thirds of the money a lot of work can be undertaken on the ground to bolster up occasional spots where there is real necessity for something better than the 4-ft contour.

In summary, it is a great extravagance to be a perfectionist as far as map requirements are concerned. A map made to the highest specifications at a large scale and a small contour interval is, of course, what everybody would like to have in approaching a project. This desire, however, must be tempered by all of the practical considerations that have been discussed.

Many cities fail to have adequate maps because of the information that has been available in trade periodicals about the cost. Great cities like Cleveland and Cincinnati, Ohio, Tacoma, Wash., and San Diego, Calif., do a comprehensive job. Many smaller cities with limited budgets get a fine job of mapping for themselves by utilizing photography only, leaving the first order triangulation and levels, and the contour maps and lithographic reproductions for their bigger brothers. Four about one tenth the cost per square mile, a city can purchase excellent photomaps made to an accurate scale and showing every feature of the city in proper relationship. Probably these photomaps will solve a large percentage of the problems that arise in the course of day-by-day city work almost as well as the more complex maps. Many small cities have been delighted to find out how much useful information they can get for prices such as $100 and $200 per sq mile, and sometimes even less.

This paper has been very thought-provoking as far as the writer is concerned, and he is grateful for this healthy stimulus to our city map thinking.

CHARLES A. BLESSING,[20] M. ASCE.—The purpose of this paper was confined to a description of the various types of base maps required in modern city planning studies. No attempt was made to describe the details involved in the preparation of finished maps showing survey data or proposed plans. It is to be greatly desired that a professional planning organization such as the American Institute of Planners, prepare a fully detailed manual of procedure for all phases of map making used by city planners in their own work. Such a manual would suggest such items as standardized symbols, patterns of hatching, and simplified titles. The standardization of survey maps as well as of base maps should accompany the general refinement of techniques in the planning field. Agreement on mapping techniques would do much to encourage sounder planning procedures in many countries that today depend on American engineers and planners for technical assistance. Such standardization would provide the means of a fuller exchange of knowledge and information on city planning practices throughout the world.

Just as the planning process increasingly involves the improvement of techniques of measurement (measurement of industrial nuisances, of standards for a healthful environment, of standards for light and air) so should it include techniques for simpler and more effective graphic presentation of ideas, simpler and more readible reports, and simpler maps as tools of analysis.

[20] Director of Planning, Chicago Plan Commission, Chicago, Ill.

Mr. Lewis clearly contrasts the two distinct phases of work divided between the city planner and the engineer. The planner, interested in location and general character of improvements, needs a true scale whereas the engineer, interested in design and construction, needs true dimensions.

In his discussion Mr. Eliel has, with sound logic, urged that more attention be given to elements that go into the decision on the choice of a suitable scale for a particular map. He then lists the degree of accuracy required, the needs for ample layout space, the need for space to contain a great deal of written descriptive matter, and the need for a convenient sheet size that, unfolded, can fit into a standard map file. With this clarification of the reasons for determination of various scales the writer is in complete agreement.

Mr. Eliel's discussion of cost of photogrammetric mapping as affected by scale and contour interval will be helpful to the planner in his choice of maps for a particular project. His summary statement that it is a great extravagance to be a perfectionist as far as map requirements are concerned is heartily agreed with by the writer.

The writer's recent experience in planning work in a large city has convinced him that commission members prefer for conference use a simple effective map prepared with generous use of colored patterns to indicate types of land use, colored scotch tape strips to indicate transportation routes, and "single idea" presentation maps made possible by use of transparent acetate overlays.

The average plan commissioner or city official would prefer that the usual complicated study maps, filled with the detail that delights the professional practitioner, be left in the file drawer in the back room. He would prefer for public hearings, commission meetings, printed reports or exhibits, that the planner submit maps with clear-cut eye appeal, simplicity, and the abundant use of color that the popular magazines have taught the public to demand.

The planner's finest vehicle for selling his plans is a set of coordinated graphic materials, such as photographs, perspective drawings, models, charts and diagrams, and most important of all—a series of clear, simple- and attractively presented maps.

The writer is appreciative of the thoughtful discussion of this paper. He believes that an opportunity lies ahead for the city planner and the civil engineer for continued improvement both of base maps and completed survey and comprehensive plan maps.

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